AN EVALUATION OF INSECT DAMAGE IN THREE SOUTHERN FEDERAL SEED ORCHARDS (1981) (BEECH CREEK - NC, FRANCIS MARION - SC, AND OCALA - FL)

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INTRODUCTION

The production of superior seed from pine seed orchards is important in the southern United States, because trees from this seed exhibit increased volume growth, improved form and fiber characteristics, and reduced disease incidence. These superior trees are being heavily relied upon to produce increased quantities of higher quality forest products per unit area (FSM 2475.02). Federal seed orchards are just beginning to produce seed in quantity in some seed sources. This seed is being depended upon to regenerate National Forest lands with superior growing stock. Approximately 17,422 pounds of seed are needed annually from southern federal seed orchards for this purpose 2/.

During 1981, the Beech Creek, Francis Marion, and Ocala orchards produced more than 5,200 pounds of superior seed, as compared to 2,778 pounds in 1980 (Table 1 - personal communication, Jim McConnell 3/). In 1979, all six Federal orchards produced 5,857 pounds of orchard seed, as compared to 13,834 pounds in 1981. Unfortunately, while production has improved for some species, such as loblolly, there are still extreme shortages in other species and sources, especially shortleaf and slash.

Insects are the chief agent causing losses in seed orchards (Overgaard, et al. 1974) and, if not controlled, will adversely affect the availability of superior pine seed, thereby reducing future timber production. Currently, there is no technique for predicting population trends of seed orchard insects. Consequently, this evaluation is based on current seed, conelet, and cone damage at the Francis Marion, Beech Creek, and Ocala orchards, and does not attempt to predict future losses.

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2/ Aycock, O. E., and R. E. Major. 1977. A study of R-8 seed processing facilities and needs. R-8 Report.

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Names of principle insect species, description of their biologies and behavior, and damage caused (Ebel et al. 1975):

CONEWORMS, Dioryctria spp.

Coneworms--Dioryctria amatella (Hulst.), D. clarioralis (Walker), D. disclusa (Heinrich), D. ebeli (Matuura and Monroe), and D. merkeli (Matuura and Monroe). Biologies of coneworms are somewhat similar. Generally, these insects attack the flowers, buds, and shoots, as well as the conelets and cones. Damage consists of larval tunnels with partly to totally excavated areas within infested structures (Ebel et al. 1975).

Coneworms, depending on the species, have one to seven generations a year. Young, first instar larvae overwinter and attack flowers and shoots the following spring. Later in the summer, cones are attacked. Some species, like D. amatella, infest fusiform rust (Cronartium fusiforme Hedg. and Hunt) galls and move to cones to complete their development.

PINE SEEDWORMS, Laspeyresia spp.

Three species are prevalent in the South--the slash pine seedworm (L. anaranjada Miller); the longleaf seedworm (L. ingens Heinrich); and the eastern pine seedworm (L. toreuta). Damage consists of larval feeding and development within maturing seeds and cones. Damage from these insects often prevents cones from opening, thereby affecting the extraction of seeds.

In general, one generation occurs each year in all species of seedworms. The adults emerge in spring, mate, and the female moth lays eggs on cones. The eggs hatch in three to six days, and young larvae bore into the cones. A larva enters a seed and completely consumes it and then bores into another seed. Each larva destroys one to seven seeds during its development and bores into the cone's axis in the fall, where it overwinters. The following spring, the larva pupates and develops to an adult moth, which emerges through a hole in one of the excavated seeds.

SEEDBUGS, Leptoglossus corculus (Say) and Tetyra bipunctata (H.-S.)

These are sucking insects which feed upon developing conelets and seeds. Adults are strong fliers, and nymphs are highly mobile, feeding on several conelets and cones during their life by puncturing them with their needle-like mouth parts. Early stages are gregarious and may kill conelets and cones. They also puncture developing seeds and destroy the endosperm, causing empty or partially developed seeds.

Leptoglossus corculus overwinters as an adult. The eggs are laid in rows on pine needles. Several generations occur each year. Nymphs or early stages are present from April through October, and adults can be found in spring, summer, and fall. In the deep South, the largest populations occur in July and August.

The shieldback bug (T. bipunctata) overwinters as an adult in the litter. This insect has one generation a year. Adult populations may become quite high in late summer and early fall.

NANTUCKET PINE TIP MOTH, Rhyacionia frustrana (Comstock)

Larvae of the Nantucket pine tip moth feed on tips of pines, destroying primordial tissue in stems during summer, thus preventing conelet production the following season. They also feed directly on young flowers and conelets in early spring. Severe infestations may greatly retard growth and cause forking of small pine trees. The hosts are shortleaf (Pinus echinata Mill.); loblolly (P. taeda L.); Virginia (P. virginiana Mill.); and sand pine (P. clausa [Chapm.] Vasey). Slash pine (P. elliottii Engelm. var. elliottii) can be attacked; however, longleaf pine is resistant to this species of tip moth.

This moth has one to five generations, with the most generations occurring in the southern part of its range. Moths emerge in late winter or early spring and lay eggs on new shoots and needles of pines. Upon hatching, larvae feed on young shoots or young flowers. About the third instar, the larvae bore into shoots where they pupate and complete development.

PINE CONEBORERS, Eucosma spp.

Eucosma cocana Kearfott, E. tocullionana Heinrich.

Damage is similar to that of Dioryctria spp., but the riddled white pine (P. strobus L.) and shortleaf pine cones tend to be packed with a mixture of chewings and frass, with no obvious tunnel system evident.

These insects usually have one generation a year. Moths emerge from pupae, overwintering in the soil about April or May, and lay their eggs. Young larvae tend to feed in groups in inmature cones and later disperse and become more solitary in infested cones. Although they disperse, the larvae tend to concentrate within major branch systems, so damaged cones are noticeably grouped within the tree crown. When mature (June-July), the larvae drop from the cones and pupate in the soil until the following spring.

WHITE PINE CONE BEETLE, Conophthorus coniperda (Schwarts)

The beetles attack the white pine cone at the cone base where it joins the stalk. A doughnut-shaped mass of resin-soaked, light brown frass is formed around the entrance hole. Attacked cones wither and die. One insect may attack several cones.

Adult females emerge in early spring and attack and lay eggs in several cones during a 30-day period. The female beetle constructs a gallery down the cone axis and lays eggs in from 1 to 24 niches in the gallery wall. The larvae feed on both cone and seed tissues. When cones are scarce, conelets are attacked, but no eggs are laid in them. One generation occurs yearly, and adults overwinter in infested cones.

OBJECTIVE

The objective of insect suppression on federal seed orchards is to achieve maximum production of superior seed with the least hazard to any non-target organisms.

GENERAL EVALUATION SURVEY TECHNIQUES

Cone damage:

Coneworm - Coneborer and Conebeetle: This damage is usually assessed one of two ways. The first method is to harvest 100 percent of the cone crop on selected clones and calculate the percent damaged cones. This method usually underestimates the amount of insect damage, as some of the damaged cones may be missing at harvest. The second technique is to employ the life table approach. This involves tagging a minimum of 10 percent of the flower crop and following them to maturity. This method is used to pinpoint the time and cause of mortality.

Seed damage:

Seedbug and seedworm: The Eastern Tree Seed Laboratory conducts two types of cone analysis to determine seed quality and insect damage (Bramlett et al. 1977).

Seed Orchard Seed Evaluation Testing (SOSET) provides a measure of seed production, viability of the extracted seed, and a radiographic analysis of the extracted seed. The radiographic analysis identifies insect problems, abnormal seed development, and the percentage of filled seed. This method is considered a continual monitoring technique.

Cone Analysis Service (CAS) consists of an in-depth analysis of seed potential of cones, number of first and second year aborted ovules, percent sound seed, percent empty seed, percent seedbug and seedworm damage, and percent malformed seed.

Adult male coneworm monitoring:

Pheromones for 4 of the 5 important coneworm species were field tested in 1980 and 1981. Beginning in 1982, these pheromones will be used by all federal orchards to continually monitor the presence and abundance of these important insect pests. This is considered to be an integral part of each orchard's insect monitoring program.

FRANCIS MARION SEED ORCHARD
METHODS

Source: Francis Marion loblolly.

Treatments:

1. Ambush - .125 percent concentration applied at one gallon per tree on a monthly basis from April 1981 through September 1981.

2. Ambush - .0625 percent concentration applied at one gallon per tree on a monthly basis from April 1981 through September 1981.

3. Guthion - .9 percent concentration applied at one gallon per tree on a monthly basis from April 1981 through September 1981.

4. Check - no treatment.

Design:

1. Twelve clones x one ramet per clone.

2. One clone x nine ramets per clone.

Cone damage:

During 1979 and 1980, an outbreak of D. disclusa caused extensive losses in seed orchards on the East Coast (Barber et al. 1981). The Francis Marion Seed Orchard is in this area. In 1980, losses were 14 percent on untreated trees. In 1981, no damage from this pest was observed. Damage from other coneworm species was low. Mean percent Dioryctria damage in the insecticide treatments was significantly lower than the 3.5 percent which occurred in the untreated check (Table 2).

All 12 clones in the untreated block had Dioryctria damage of less than 4 percent, except clone 9, which was 21.9 percent. Therefore, an additional evaluation of just clone 9 showed damage in the untreated area of 31.2 percent. Clone 9 ramets in both Ambush treatments had less than 4.3 percent Dioryctria damage, while the Guthion treated ramets had 5 percent.

No seedbug damage was observed in the seed from the check trees; therefore, further testing of seed from the treated trees was discontinued. Low seedbug populations are suspected for the lack of seedbug damage. This lack of a seedbug population was observed in the field during the summer.

In 1980, only 336 pounds of seed were produced from the source, as compared to 2,447 pounds in 1981. In 1980, this source yielded .90 pound of seed per bushel, while 1.35 pounds per bushel were produced in 1981.

Source: S.C. piedmont loblolly.

Treatments:

1. Guthion applied by mist blower at 30-day intervals from six days past peak pollen flight to cone harvest.

2. Control - untreated.

Design:

Approximately 10 percent of the flower crop is tagged at flower initiation and followed until harvest. This is part of the orchard's ongoing cone monitoring system.

Flower to cone harvest:

Survival of the flower crop to harvest was good during 1980-1981, averaging nearly 89 percent (Appendix 1). Emphasis was placed on protecting this bumper crop from D. disclusa and other insects by spraying Guthion both years. Seed production increased in 1981 to 2,446 pounds from 366 pounds in 1980.

Source: N.C. longleaf, S.C. longleaf, and Ga. shortleaf.

Treatments:

1. Ga. shortleaf - Guthion.

2. N.C. longleaf and S.C. longleaf - none.

Longleaf:

Ongoing orchard monitoring determined cone efficiencies (flower to cone harvest survival) for the N.C. longleaf and S.C. longleaf sources to be 65 and 62 percent, respectively (Appendices 2, 3). There was a great variation in cone efficiencies by clone, ranging from 0 to 100 percent. Seed production on these two longleaf sources increased in 1981 to 403 pounds from 36 pounds the previous year.

Shortleaf:

Shortleaf production fell in 1981 to 129 pounds from 157 pounds the previous year. Cone efficiency in a Guthion treated area was 52 percent (Appendix 4). Overall seed production, as measured by pounds of seed per bushel, was 1.04 in 1980 and .61 in 1981.

RECOMMENDATIONS

1. Producing loblolly, longleaf, and shortleaf sources should be treated monthly with Guthion 2S, applied via aircraft at the rate of 3 pounds active ingredient per acre. If this method of application is not possible, apply Guthion 2S via mist blower at the rate of 1 gallon of spray mix per tree. Treatments should begin six days after pollen flight and continue every 30 days through August.

2. The last spray treatment, which normally occurs in September during cone harvest, should be with the newly registered insecticide, Pydrin.

3. Establish 20 pheromone monitoring traps to determine relative population densities and activity periods of four coneworm species.

4. If aerial applications are used (either Guthion or Pydrin), add Nalcotrol at the rate of 2-3 ounces per 100 gallons of tank mix as a drift retardant.

5. Reentry time for either Guthion or Pydrin is 48 hours.

6. Spray Mix Table:

Chemical	Via Mist Blower	Via Air
Guthion 2S	Mix 3 pints in 10 gallons of water. Apply 1 gallon per tree.	Mix 1-1/2 gallons (3 lbs. AI) with 8-1/2 gallons of water. Apply 10 gallons of spray mix per acre.
Pydrin	Mix 3.5 pints in 100 gallons of water. Apply 100 gallons of spray mix per acre.	Mix .31 gallons (.75 lbs. AI) with 9.69 gallons of water. Apply 10 gallons of spray mix per acre.

Table 1.--Cone and seed production from three federal seed orchards, 1980-1981.

Orchard	Source	Bushels		Pounds		Pounds per Bushel	
		1980	1981	1980	1981	1980	1981
Francis Marion	S.C. longleaf	44	283	10	150	.23	.53
	N.C. longleaf	28	223	26	253	.92	1.14
	Ga. loblolly	248	245	322	340	1.30	1.39
	S.C. piedmont loblolly	373	1820	336	2447	.90	1.35
	Francis Marion Coastal loblolly	125	500	228	852	1.82	1.70
	Ga. shortleaf	151	210	157	129	1.04	.61
	Orchard Total	969	3281	1079	4171		
Beech Creek	Ky. shortleaf	64	60	59	64	.92	1.07
	N.C. shortleaf	123	120	110	54	.89	.45
	Va. shortleaf	32	2/	26	2/	.81	2/
	White pine	2112	1958	1499	834	.69	.43
	Virginia pine	2/	1/	2/	1/	2/	1/
	Orchard Total	2331	2138	1594	952		
Ocala	Sand pine	4/	250	5	3/	4/	3/
	Grand Total	3300	5669	2778	5123		

1/ Field observations indicated few sound seed per cone; therefore, the crop was not harvested.

2/ The crop was not harvested.

3/ Seed were not extracted as of March 1982.

4/ Unknown.

Table 2.--Mean percent Dioryctria[1/] damaged cones - Francis Marion loblolly, 1981.

Treatment (% AI)	Percent Damage of all Clones	Percent Clone 9 Damage
Ambush .125	.4 a[3/]	2.6
Ambush .0625	.9 a	4.3 a
Guthion .9	1.4[4/]	5.0[4/]
Check - untreated	3.5 b	31.0

1/ Does not include D. disclusa damage.

2/ Applied by mist blower.

3/ Any two means not having a letter in common are significantly different at the 5 percent level according to Duncan's New Multiple Range Test.

4/ This treatment was not part of the experiment, because it was not randomly assigned.

BEECH CREEK SEED ORCHARD
METHODS

Source: N.C. white pine.

Treatments:

1. Furadan applied at 4 ounces per inch dbh.

2. Check - untreated.

Design:

1. Six clones x two ramets per clone.

2. Ten percent of flower and cone crop.

Flower to cone survival:

More 1980 flowers survived to harvest, August 1981, (91.6%) in the area treated with Furadan than in untreated areas; 91.5 percent vs. 88.4 percent, respectively (Table 3). Identifiable insect damage (conebeetle and coneborer) was light, with 3.4 percent in the untreated area, as compared to 0.8 percent in the Furadan treatment area. This difference between treatments was not statistically significant. In 1981, there were 1,958 bushels harvested, as compared to 2,112 in 1980.

Seed analysis:

There was no improvement in the percent of potentially sound seed with the use of Furadan during 1981 where 20 percent sound seed was detected in the untreated area, as compared to 18 percent in the treated area (Table 4). This difference was not statistically significant. Orchard seed yields dropped from .69 pounds in 1980 to .43 pounds per bushel in 1981.

Flower survival:

Nearly 16 percent more flowers survived through late June in the area treated with Furadan than in the untreated area; however, the difference was not statistically significant (Table 5). Overall flower mortality was high, with 59.5 percent and 43.7 percent mortality in the untreated and treated areas, respectively. There are no known reasons for this mortality. These losses, in combination with a smaller flower crop during 1981, result in a very small potential 1982 white pine cone crop. There will be no planned chemical control in this source to protect the 1982 cone crop. Insecticide treatments will only be used if the 1982 flower crop is of sufficient size to justify its use.

METHODS

Source: N.C. shortleaf.

Treatments:

1. Furadan, 10 percent applied at 4 ounces per inch dbh.

2. Check - no treatment.

Design:

1. Six clones x two ramets per clone.

2. Ten percent of flower and cone crop.

Cone and conelet mortality:

Overall cone and conelet survival during 1981 was good in either treated or untreated areas (Table 6). There were slightly more sound cones at harvest in the check block than where Furadan was used--88.7 and 87.3 percent, respectively. Total insect damage to cones was identical in either treatment block at 7.8 percent. More conelets survived in the Furadan treated areas than in the untreated areas--80.8 percent 71.7 percent, respectively. This was statistically significant at the 5 percent level.

Cone and seed production:

The orchard harvested about the quanity of cones in 1980 as in 1981; i.e., 123 vs. 120 bushels, respectively. Total seed produced in 1981 was 54 pounds, down from 110 pounds the previous year. The reason for this drop in seed production is unknown.

RECOMMENDATIONS

1. On producing sources, apply Guthion 2S by aircraft at 30-day intervals beginning at flower closure and continuing through August. If this method of application is not possible, apply Guthion 2S via mist blower at the rate of 1 gallon of spray mix per tree.

2. The last spray treatment (Virginia and shortleaf pine), which normally occurs in September during cone harvest, should be with the newly registered insecticide, Pydrin. On white pine, apply Pydrin in early August just before harvest. Guthion should be used in mid-September to protect the conelets from seedbug attack.

3. Establish 20 pheromone monitoring traps to determine relative population densities and activity periods of four coneworm species.

4. If aerial application is used (either Pydrin or Guthion), add Nalcotrol at the rate of 2-3 ounces per 100 gallons of tank mix as a drift retardant.

5. Reentry time for either Guthion or Pydrin is 48 hours.

6. Spray Mix Table:

Chemical	Via Mist Blower	Via Air
Guthion 2S	Mix 3 pints in 10 gallons of water. Apply 1 gallon per tree.	Mix 1-1/2 gallons (3 lbs. AI) with 8-1/2 gallons of water. Apply 10 gallons of spray mix per acre.
Pydrin	Mix 3.5 pints in 100 gallons of water. Apply 100 gallons of spray mix per acre.	Mix .31 gallons (.75 lbs. AI) with 9.69 gallons of water. Apply 10 gallons of spray mix per acre.

Table 3.--Flower to cone survival[1/] - N.C. white pine - Beech Creek Seed Orchard, 1981.

Treatment	Healthy	Insect Damage	Other or Unknown
		percent	
Check	88.4 a	3.4 a [2/]	8.2 a
Furadan, 4 oz.	91.6 a	.8 a	7.6 a

1/ Flowers initiated in spring, 1980.

2/ Any two means not having a letter in common are significantly different at the 5 percent level.

Table 4.--Seed evaluation - N.C. white pine - Beech Creek Seed Orchard, 1981.

Treatment	1st yr. Aborted	2nd yr. Aborted	Insect Damage	Empty	Sound	Miscellaneous	Average Seed Production Efficiency
	percent						
Check	57 a 1/	4 a	0 a	14 a	20 a	5 a	20
Furadan 4 oz/in dbh	62 a	2 a	0 a	11 a	18 a	7 a	18

1/ Any two means not having a letter in common are significantly different at the 5 percent level.

Table 5.--Flower survival[1/] - N.C. white pine - Beech Creek Seed Orchard, 1981.

Treatment	Healthy	Dead
	- - - - percent - - -	
Check	40.5 a 2/	59.5
Furadan, 4 oz.	56.3 a	43.7

1/ 1981 flower crop survival through 6/21/81.

2/ Any two means not having a letter in common are significantly different at the 5 percent level.

Table 6.--Cone and conelet mortality on carbofuran vs untreated N.C. shortleaf pines - USFS, Beech Creek Seed Orchard, Murphy, N.C., 1981.

	Cones				Conelets	
Treatment	Healthy	Unknown	Dead Coneworm	Coneborers	Healthy	Dead
Furadan, 4 oz.	87.3 a 1/	4.9 a	1.3 a	6.5 a	80.8 a	19.2 a
Check	88.7 a	3.5 a	2.1 a	5.7 a	71.7 b	28.3 b

1/ Any two means not having a letter in common are significantly different at the 5 percent level.

OCALA SEED ORCHARD
METHODS

Source: Ocala sand pine.

Treatments:

1. Furadan, 2 ounces per inch dbh, applied in January.

2. Check - no treatment.

Design:

1. Six clones x two ramets per clone.

2. Ten percent of flower and cone crop.

Flower and cone survival:

Almost 4 percent more of the 1980 flower crop survived to be harvested in the fall of 1981 in a Furadan treated area than in an untreated area; i.e., 66.9 and 63 percent, respectively; however, this was not statistically significant (Table 7). Insect damage (coneworm) was 9.4 percent in the untreated area and 7.4 percent in an area treated with Furadan. This difference was also not significant.

The survival of the 1981 flower crop follows the same pattern, where more flowers survived in the treated areas than in the untreated. There was also more insect damage (tip moth) to the flower crop in the untreated area than in the treated area; i.e., 11.2 and 8.3 percent, respectively (Table 8). There was no statistically significant difference between treatments for flower survival or insect damage.

Seed analysis:

In samples from 72 cones, there were 5,617 full seed produced in the area treated with Furadan and only 4,836 seed in an area where no insecticide was used (Table 9). This is a difference of 781 full seed in a sample of 72 cones. For full seed, there were no statistical difference between treated or untreated cones (73.6 vs 73.7 percent). As this data was from a SOSET analysis, which does not look at aborted ovules, only developed seed, the full impact of seedbug damage may have been missed. Insect damage, as observed on the radiograph, was high at 13 and 12.4 percent in the treated and untreated areas, respectively. Perhaps the lack of insect control was due to the dry conditions which existed on the orchard during 1981. It is also interesting to note the difference between the average number of seed per cone by treatment, which was statistically significant at the 5 percent level. There were 106.1 seed per cone in the Furadan area, as compared to 92 in the untreated area.

RECOMMENDATIONS

1. Continue to treat the orchard with Furadan 10G at 2 ounces per inch dbh in January, except for the check area. The Furadan should be applied with the Powr-Till seeder to maximize incorporation.

2. An evaluation should be conducted to determine the best time of year to apply Furadan. Entomologists with FPM are cooperating with the orchard manager to accomplish this goal.

3. Establish 20 pheromone monitoring traps to determine relative population densities and activity periods of four coneworm species.

Table 7.--Flower to cone survival - Ocala sand pine - Furadan evaluation - USFS, Ocala Seed Orchard, 1981.[1/]

Treatment	% Healthy Cones	% Insect Damaged Cones	% Other Damaged Cones
Furadan, 2 oz.	66.9 a [2/]	7.4 a	25.7 a
Check	63.0 a	9.4 a	27.6 a

1/ Survival period - 1/80 - 10/81.

2/ Any two means not having a letter in common are significantly different at the 5 percent level.

Table 8.--Flower survival - Ocala sand pine - Furadan evaluation - USFS, Ocala Seed Orchard, 1981.[1/]

Treatment	% Healthy Flowers	% Insect Damaged Flowers	% Other Damaged Flowers
Furadan, 2 oz.	65.0 a [2/]	8.3 a	26.6 a
Check	61.1 a	11.7 a	27.8 a

1/ Flower to conelet survival - 1/81 - 10/81

2/ Any two means not having a letter in common are significantly different at the 5 percent level.

Table 9.--Seed analysis[1/] - Ocala Sand Pine Seed Orchard, 1981.

Treatment	Full	Empty	Insect	Seed per Cone
	----- percent ----			
Furadan, 2 oz.	73.6 a[2,3/]	13.6 a	13.0 a	106.1 a
Check	73.7 a[2/]	13.9 a	12.4 a	92.0 a

1/ Analysis = seed extractions and radiographs only (SOSET).

2/ Sample size was 72 cones in each treatment. There were 5,617 full seed in the Furadan treatment and 4,836 full seed in the untreated treatment.

3/ Any two means not having a letter in common are significantly different at the 5 percent level.

GENERAL DISCUSSION

Suppression projects generally yielded positive increases in sound cones and full seed where insecticides were used. This is especially true on the Francis Marion Seed Orchard, where seed production jumped dramatically in 1981 to 4,171 pounds from 1,079 pounds in 1980. This orchard in 1981 changed from Furadan to Guthion for insect control. In comparison, the Beech Creek Seed Orchard stayed with Furadan during 1981, and its seed production fell from 1,594 in 1980 to 952 pounds in 1981. If insect control is the problem, then it is probably the result of poor uptake of the Furadan because of the 1980-1981 drought. Changing to Guthion and Pydrin should remedy this situation on the Beech Creek Seed Orchard in 1982.

Aerial application of insecticides is now recommended for the Beech Creek and Francis Marion Seed Orchards. The technology has been developed in the past two years and has proven effective. Most private industry orchards are already using aerial application. This method of application has several advantages:

1. Reduction in total insecticide usage (environment impact).

2. Better timing of application.

3. Less off-target drift of toxic insecticides.

4. Less exposure to workers.

5. Cost reduction (see 1 above); often a sizeable reduction in insecticide expenditures.

The use of pheromones is also new to federal orchards. This technology was only developed within the last three years. This year (1982), over 70 orchards across the South are expected to use pheromones to determine the relative coneworm populations on their orchards. In future years, managers may be using pheromone traps to time pesticide applications and to predict pest problems.

The insecticide, Pydrin, was recently registered for use on seed orchards. This insecticide offers the advantage of being much safer to use than Guthion. Unfortunately, the label allows the application of no more than 2.4 pounds active ingredient per year. This means; that by ground equipment (mist blower), only two applications are allowed and three if application is by aircraft. Under present spray schedules, 5 or 6 applications are needed for season-long protection.

The recommendations contained herein call for the use of one application of Pydrin at the time the field workers will be collecting cones. This should increase worker safety at cone collection time, as well as provide an extra margin of protection against seedbugs, which are common at this time of year. Pydrin is thought to have longer residual activity in the field than Guthion, thus yielding the extra protection.

Further evaluations of this product in the field will give information on how to effectively use Pydrin in conjunction with Guthion or Furadan to maximize insect control.

Appraisal of current significance

Coneworm damage was generally lower in 1981 than 1980 on the Francis Marion Seed Orchard. This was the result of a more aggressive insect control program. Coneworm damage and seedbug damage on the Ocala Seed Orchard were on the increase in 1981. This orchard is now reaching production levels, which warrant additional imputs of insecticide for control. An evaluation to determine optimum timing for the application of Furadan is currently underway.

Conebeetle and coneborer damage to the Beech Creek Seed Orchard white pine remained low in 1981 at 3.4 percent in the untreated area, as compared to .8 percent in the Furadan treated areas. For comparison, an untreated area in 1978 had 28 percent mortality, while in 1979 and 1980, the loss was less than 1 percent.

Seedbugs continue to cause considerable damage to some orchards and less to others. On both the Ocala and Beech Creek Seed Orchards, damage was observed on the radiographs. In comparison, no damage or seedbug activity was observed on the Francis Marion Seed Orchard.

Appraisal of potential significance

The reproduction potential of each insect species involved is not known. Any one species is capable of causing serious losses in any given year and losses exceeding 90 percent of the possible seed crop are not unusual.

Course of the outbreak if unchecked

The course of the outbreak, if left unchecked, is unknown. Populations of the different species of insects affecting pine seed production fluctuate considerably from year to year according to climatic conditions and parasite-predator populations. However, it is known that serious losses will continue unless checked.

Course of the outbreak if checked

Although excessive seed and cone losses will be prevented by treatments during the year of application, continued treatments will be needed from year to year due to rapid build-up of insect populations in the orchard and reinfestation of populations from wild pine stands.

RECOMMENDATIONS

Insect control recommendations were made under the discussion of each orchard.

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Appendix 1.--Francis Marion Seed Orchard, S.C., piedmont loblolly[1/] cone efficiency and seed analysis from selected clones and ramets, 1981.

Tree I.D.	Cone Efficiency (%)[2/]	Percent Full Seed	Percent Insect
1A14	88	43.3	3
2A45	90	81.7	0
4H5	67	75.2	0
4I6	93	84.5	0
4A22	96	95.8	0
4C28	99	91.6	0
4E30	98	85.9	0
5C11	51	89.4	0
5H30	93	92.8	0
5I30	88	81.7	0
5H34	94	93.3	0
6I5	100	68.6	0
6A22	89	92.1	0
7H7	100	90.3	0
7A9	92	93.7	0
7C11	54	89.1	0
7B16	90	89.1	0
7B28	97	92.5	0
8D1	89	92.9	0
8C7	94	91.5	0
8F28	98	90.7	0
8J38	90	73.7	0
8I41	72	87.2	0
8J48	93	84.9	0
9A5	96	68.9	0
9J23 3/	42	92.3	0
9D29 3/	70	87.7	0
9C40 3/	76	95.1	0
10G10	70	92.8	0
10D39	100	96.7	0
12F1	89	85.2	0
12A18	95	88.5	0
12D39	91	96.7	0

1/ Treated in 1980 and 1981 with Guthion.

2/ Cone survival at harvest as a percent of flower crop.

3/ Untreated in 1980 and 1981.

Appendix 2.--Francis Marion Seed Orchard, S.C. longleaf flower to cone survival[1/], 1981.

Tree Location	Number of Female Flowers	Number of Cones Collected	Cone Efficiency[2/]
10D3	100	67	67%
10D6	160	160	100%
10C6	129	107	83%
10C8	72	15	21%
10F30	85	54	64%
10D31	36	11	31%
10F31	41	4	10%
10D32	112	28	25%
10F32	115	90	78%
10A48	8	0	0%
	858	536	62%

1/ Total tree counts - 4/80 - 10/81.

2/ Cone survival at harvest as a percent of flower crop.

Appendix 3.--Francis Marion Seed Orchard, N.C. longleaf flower to cone survival[1/], 1981.

Tree Location	Number of Female Flowers	Number of Cones Collected	Cone Efficiency[2/]
4J3	142	142	100%
4J48	144	0	0%
4J46	114	105	92%
4I48	182	94	52%
4I46	169	169	100%
4I45	135	63	47%
4I43	189	23	12%
4I42	154	33	21%
4H3	134	134	100%
4H46	120	120	100%
4H45	155	-	
4H43	107	107	100%
4H42	97	21	22%
4G3	230	230	100%
4G48	220	104	47%
4F45	100	86	86%
4F43	126	73	58%
4F42	121	78	64%
4E46	135	135	100%
4E45	61	61	100%
4D42	120	62	52%
3E48	75	47	63%
3D48	135	81	60%
	3010	1968	65%

1/ Total tree counts - 4/80 - 10/81.

2/ Cone survival at harvest as a percent of flower crop.

Appendix 4.--Francis Marion Seed Orchard, Ga. shortleaf flower to cone survival[1/], 1981.

Tree Location	Number of Female Flowers	Number of Cones Collected	Cone Efficiency[2/]
3I4	28	19	68%
4A40	55	37	67%
4D14	10	0	0%
4C15	31	3	9%
5D32	29	23	79%
5D34	85	58	68%
5D38	116	75	65%
5F43	13	8	62%
5I12	29	10	34%
5J19	45	0	0%
11C34	93	61	66%
5A16	43	14	33%
5A30	44	25	57%
6A37	38	38	100%
6F35	50	29	58%
8B38	62	36	58%
8B36	69	18	26%
8D4	35	1	3%
8D7	20	10	52%
	895	465	52%
No Insect Control			
1J4	36	27	75%
7A18	29	8	28%
	65	35	54%

1/ Counts from eight tagged branches - 4/80 - 9/81.

2/ Cone survival at harvest as a percent of flower crop.

Forest Pest Management
Asheville Field Office

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AN EVALUATION OF INSECT DAMAGE IN THREE SOUTHERN FEDERAL SEED ORCHARDS (1982) BEECH CREEK - NC, FRANCIS MARION - SC, AND OCALA - FL

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